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Direct numerical simulation of transonic shock wave/boundary layer interaction MATTEO BERNARDINI, SERGIO PIROZZOLI, FRANCESCO GRASSO, Dipartimento di Meccanica e Aeronautica, Università di Roma La Sapienza — The interaction of a normal shock wave with a turbulent boundary layer over a flat plate at $M_\infty = 1.3$, $Re_\theta = 1300$ is investigated by means of DNS. The mean flow pattern consists of an upstream fan of compression waves associated with the thickening of the boundary layer and the supersonic region is terminated by a nearly-normal shock foot, which is observed to be significantly bent away from the wall. At the selected conditions the flow does not exhibit separation in the mean. However, the interaction region is characterized by unsteady instantaneous flow reversal in a very large zone, extending for many (upstream) boundary layer thicknesses past the nominal location of the interacting shock, and by the unsteady release of large vortical structures. The adverse pressure gradient tends to suppress the span-wise fluctuations in the near wall region across the interaction, thus yielding two-component isotropic turbulence in the neighborhood of the wall. Frequency-spectra of the wall pressure signature in the interaction region do not reveal the existence of organized low-frequency motions.

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